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REGULAR ARTICLE

Silica-coated iron-oxide nanoparticles doped with Gd(III) complexes as potential double contrast agents for magnetic resonance imaging at different field strengths

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Abstract. In the present work, we have prepared the ~10 nm superparamagnetic iron-oxide nanoparticles by means of high-temperature decomposition of iron oleate precursor. Then they were coated with silica shell to impart water-solubility and an ability to accommodate paramagnetic Gd(III)-based complexes inside silica coating. All of the prepared nanoparticles form stable in time aqueous dispersions and show good negative or/and positive contrasting effect at different magnetic field strengths (0.47, 1.41, 14.1 T). It has been also exemplified that the incorporation of [Gd(TCAS)] complexes into silica shell triggers a significant increase of the transverse relaxivity of the core–shell nanoparticles. The correlation between relaxometric properties and morphology of the obtained nanoparticles was revealed. The non-toxicity of the obtained nanoparticles along with their ability to shorten both transverse and longitudinal relaxation rates of water protons make them good candidates for their use as dual-mode contrast agents in MRI.

Keywords. Double contrast agents; silica nanoparticles; longitudinal relaxivity; transverse relaxivity.

1. Introduction

Iron-oxide nanoparticles along with Gd(III) chelates have attracted significant attention of researches in recent decades as potential contrast agents in MRI due to their ability to shorten transverse and longitudinal relaxation times of water protons, respectively, allowing better interpretation of different tissue lesions and abnormalities in a non-invasive manner.[1–3] The commonly applied single-mode imaging agents, which are based either on iron-oxides or Gd(III) chelates, suffer from some drawbacks. For instance, Gd(III) chelates raise the toxicity and high mobility issues, whereas the

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